What is claimed is:

1. A method for manufacturing a synthesized silica glass optical member, said method comprising:

providing a porous silica glass body;

heating the porous silica glass body in an atmosphere containing hydrogen; and

sintering the porous silica glass body in an atmosphere containing a fluorine compound.

2. The method according to claim 1, wherein a temperature of said heating is within a range from 500 °C to a critical temperature below which the porous silica glass body does not shrink.

3. The method according to claim 2, wherein a temperature of said heating is 1250 °C or below.

4. The method according to claim 1, wherein said heating precedes said sintering.

5. The method according to claim 1, wherein said providing the glass body includes forming glass particles by flame hydrolysis of a raw material.

6. A method for manufacturing a synthesized silica glass optical member, said method comprising:

providing a porous silica glass body;

heating the porous silica glass body in an atmosphere containing oxygen; and

sintering the porous silica glass body in an atmosphere containing a fluorine compound.

7. The method according to claim 6, wherein a temperature of said heating is within a range from 500 °C to a critical

temperature below which the porous silica glass body does not shrink.

8. The method according to claim 7, wherein a temperature of said heating is 1250 °C or below.

9. The method according to claim 6, wherein said heating precedes said sintering.

10. The method according to claim 6, wherein said providing the glass body includes forming glass particles by flame hydrolysis of a raw material.

11. The method according to any one of claims 1-10, wherein the fluorine compound comprises SiF_4.

12. A synthesized silica glass optical member manufactured by a method according to any one of claims 1-11.

13. A method for a lithography using a photo mask, in which the photo mask utilizes a glass optical member, said method comprising:

providing a porous silica glass body for the glass optical member;

heating the porous silica glass body in an atmosphere containing hydrogen; and

sintering the porous silica glass body in an atmosphere containing a fluorine compound.

14. The method according to claim 13, further comprises providing a light source of the lithography having a wavelength of 400nm or less.

15. The method according to claim 14, wherein the light

source includes an F_2 excimer laser a light source.

16. A method for a lithography using a photo mask, in which the photo mask utilizes a glass optical member, said method comprising:

providing a porous silica glass body for the glass optical member;

heating the porous silica glass body in an atmosphere containing oxygen; and

sintering the porous silica glass body in an atmosphere containing a fluorine compound.

17. The method according to claim 16, further comprises providing a light source of the lithography having a wavelength of 400nm or less.

18. The method according to claim 17, wherein the light source includes an F_2 excimer laser a light source.